MONITORING THE RECOVERY OF STREAMS IN THE SAN GABRIEL MOUNTAINS (CA) FOLLOWING THE LARGEST WILDFIRE IN LOS ANGELES COUNTY HISTORY: STATION FIRE - 2009

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Kristy Morris, Council for Watershed Health

Acknowledgements

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- Ken Franklin, City of LA
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- Aquatic Bioassay Field Sampling Crews
- Council for Watershed Health
- The majority of the SGRRMP monitoring funding was provided by Los Angeles County Sanitation District
- The majority of the LARWMP monitoring funding was provided by the City of Los Angeles

SGRRMP & LARWMP Programs

- Watershed-wide monitoring program established in 2005 and 2008
- Multiple Stakeholders including LA County Sanitation District, the Cities of LA and Burbank, LADPW, OCPW, LARWCB, and others
- Programs are designed to complement and/or coordinate with the State Water Resource Control Board Monitoring Programs

San Gabriel and Los Angles River Watersheds

- SGR Watershed
  - 689 mi^2
  - ~2 million people
  - 54% undeveloped, mostly in the Upper Watershed
- LAR Watershed
  - 801 mi^2
  - ~4.5 million people
  - 45% undeveloped, mostly in the Upper Watershed

Los Angeles River Watershed

San Gabriel River Watershed

Monitoring Questions

1.

What is the health of streams ?

2.

Conditions at areas of unique importance ?

3.

Are regulated discharges meeting WQ objectives ?

4.

Is it safe to swim?

5.

Is it safe to eat fish ?

State of the Watershed

Angeles National Forest

- Lies between the Los Angles Basin and Mojave Desert
- Comprised of 650,000 acres of land
- Elevations Range from 1,200 to 10,064 ft.
- Habitat includes dense chaparral with oak woodlands, and pine and fir forest in higher elevations

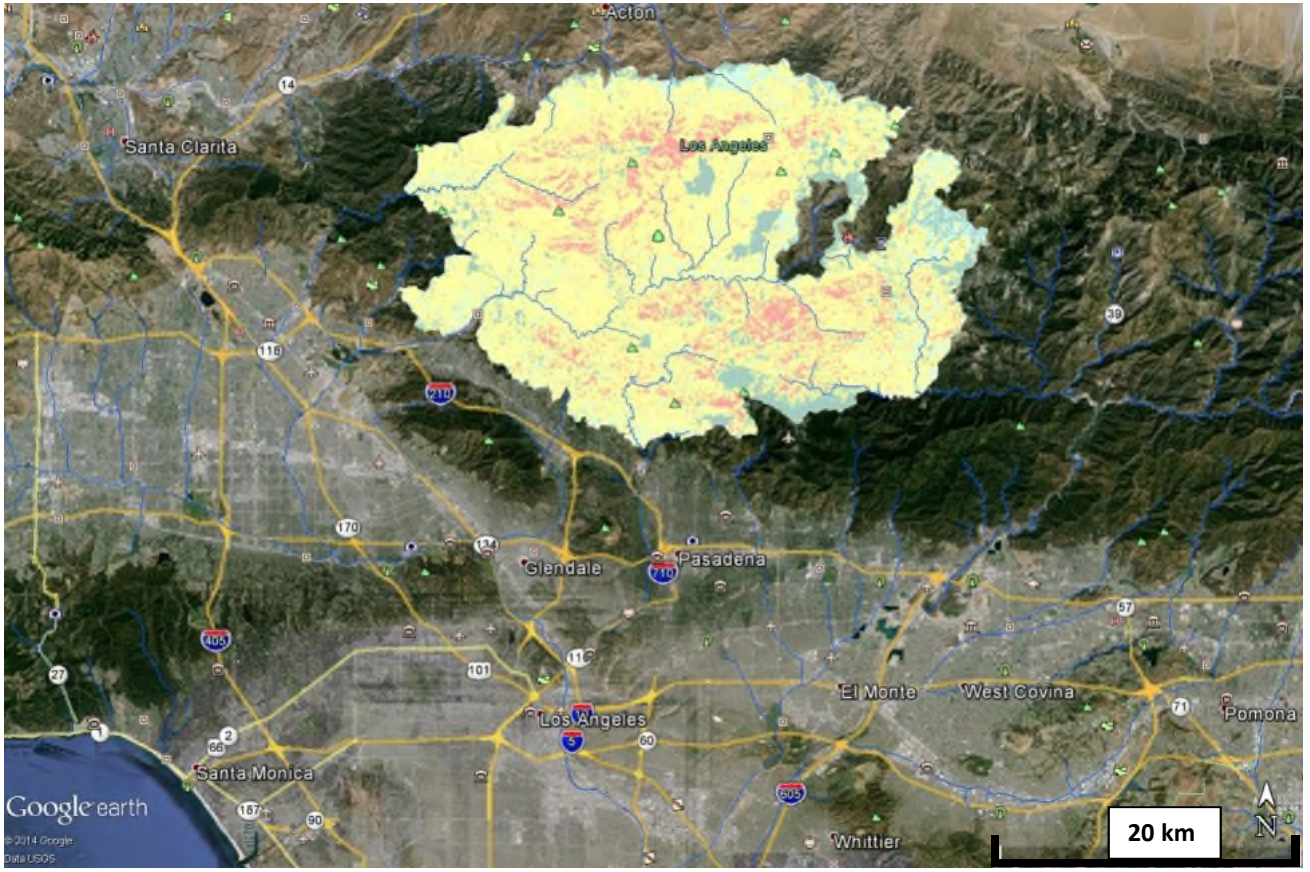
"Not even in the Sierra have I ever made the acquaintance of mountains more rigidly inaccessible" John Muir

Angeles National Forest

2009 Station Fire

- Fire started on August 29th, 2009
- 100 % contained on October 16th, 2009
- 161,189 acres (~252 sq mi.) burned
- Four major watershed impacted
  - Los Angeles, San Gabriel, Santa Clara & Mojave

2009 Station Fire



2009 Station Fire

The estimated cost to fully contain the Station Fire was $95,300,000

- Infrastructure destroyed or damaged
  - $4 million fire station
  - Historic Vetter Mountain fire lookout tower
  - 320 mi. of service roads and 225 mi of trails
- Resources Damaged
  - 37,000 acres forests, including pine, fir, oak
    - 11,000 acres will not return w/o human intervention
  - Wildlife Resources
    - California condor, mountain yellow-legged frog, Santa Ana sucker

2009-2010 Rainfall

Date	Storm Total (in.)
Oct. 13-14, 2009	2.3 to 2.5
Nov. 12, 2009	0.75 to 1.1
Dec 7, 2009	0.8 to 1.4
Dec. 11-13, 2009	1.9 to 5.8
Jan. 18, 2010	2.1 to 4.3
Jan. 19, 2010	0.4 to 0.7
Jan. 20, 2010	1.0 to 1.8
Feb. 6, 2010	3.1 to 4.4
Feb 9, 2010	0.4 to 0.9
April 11, 2010	0.9 to 1.3

Hydrologic Response	
	Negligible
	Localized damaging debris flows and flooding
	Widespread damaging debris flows and flooding

USFS, 2010. Station Fire BAER Revisit

SGRRMP & LARWMP Ambient Monitoring Programs

- Ambient monitoring program provided established pre-fire sites with a suite of indicators
- Workgroup moved quickly to provide post fire monitoring resources

Multiple Lines of Evidence (MLOE)

1.

What is the health of streams ?

- Benthic Macroinvertebrates
- Benthic Algae

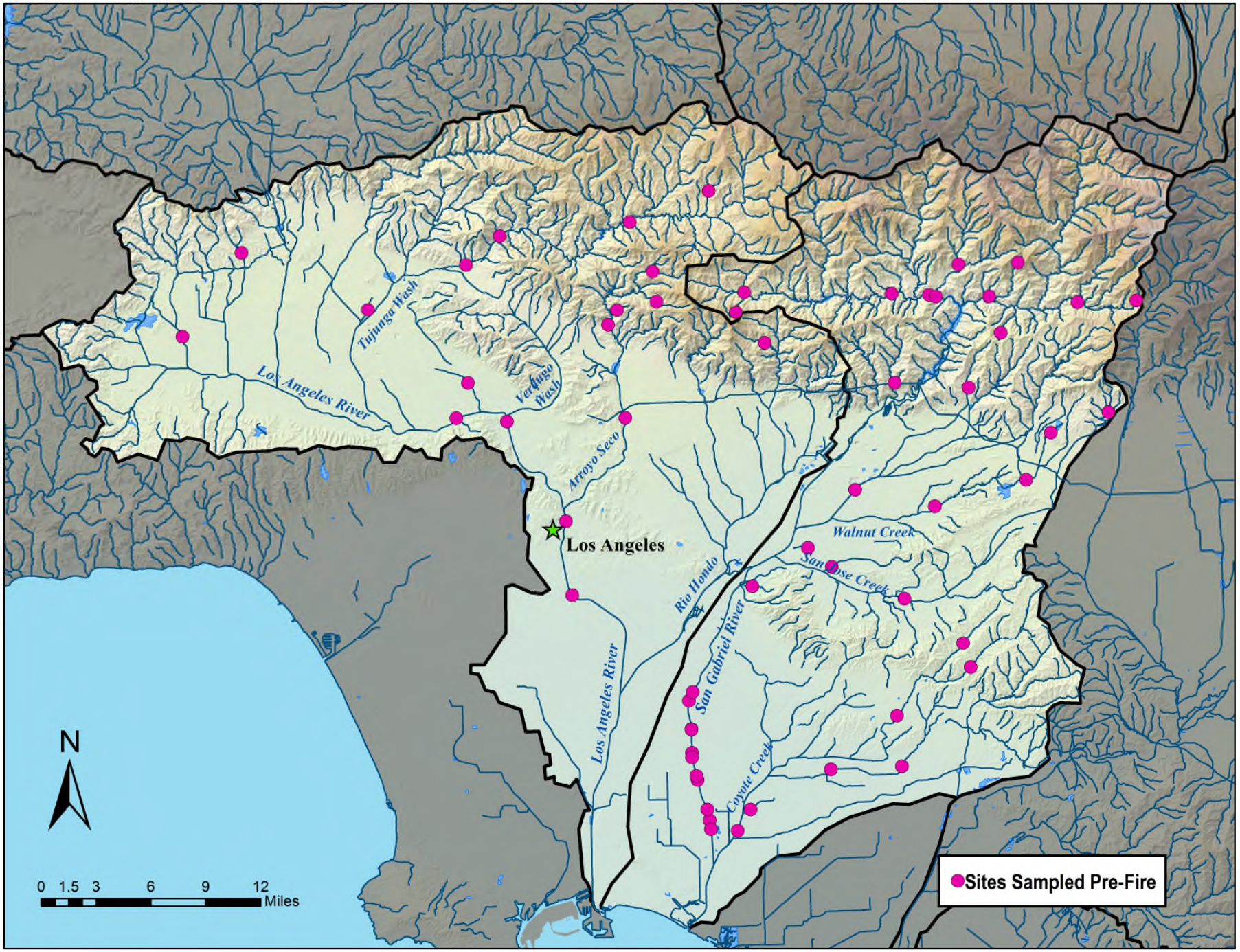
- General Constituents
- Metals
- Nutrients
- Organics

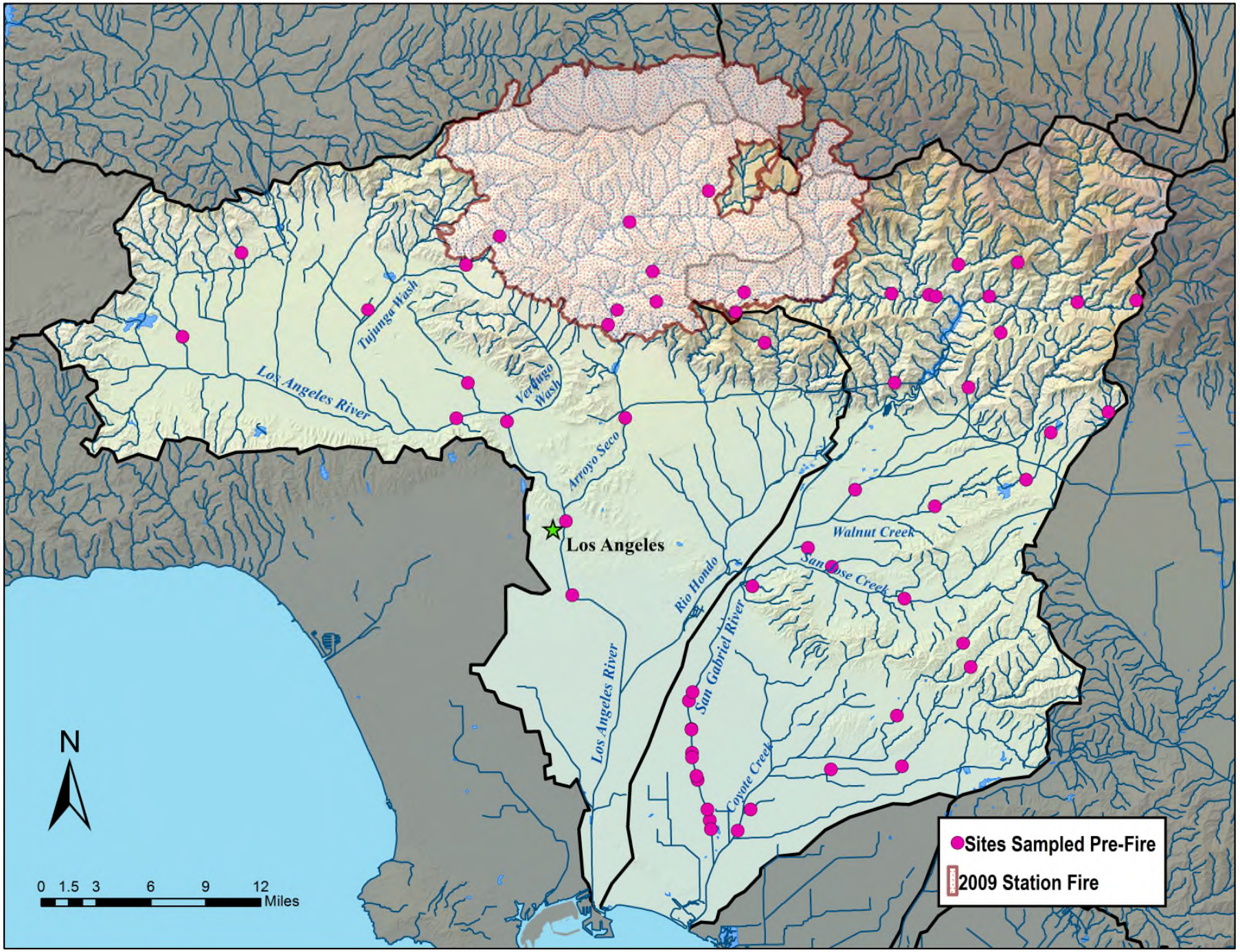
Water Chemistry

Condition ?

Physical Habitat

Toxicity


Tujunga Wash
Los Angeles River
Verdugo Wash
Arroyo Seco
Los Angeles
Rio Hondo
Walnut Creek
San Jose Creek
San Gabriel River
Los Angeles River
Coyote Creek
N
0 1.5 3 6 9 12
Miles
Sites Sampled Pre-Fire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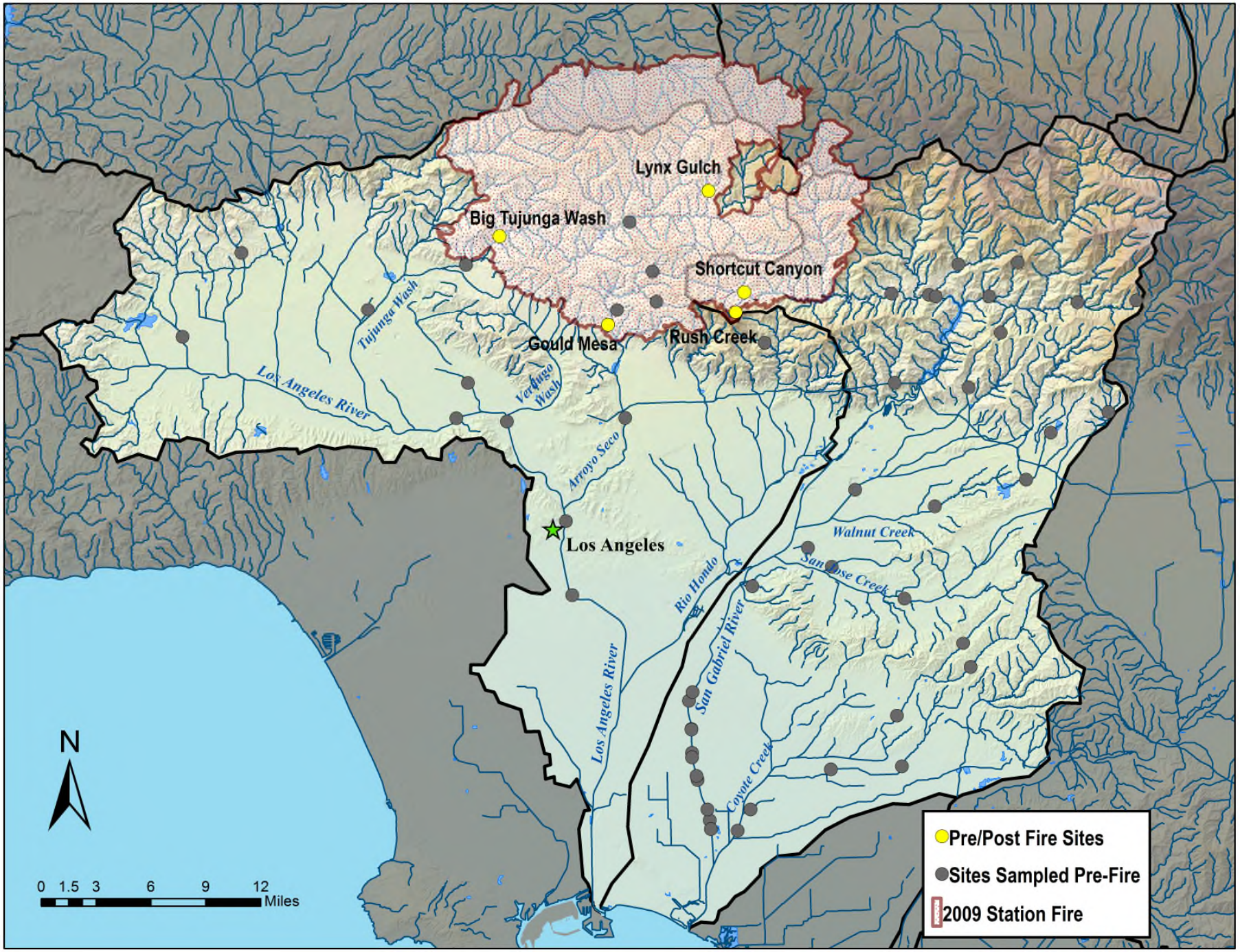

Lynx Gulch
Big Tujunga Wash
Shortcut Canyon
Gould Mesa
Rush Creek
Tujunga Wash
Los Angeles River
Verdugo Wash
Arroyo Seco
Los Angeles
Walnut Creek
San Jose Creek
Rio Hondo
San Gabriel River
Los Angeles River
Coyote Creek
N
0 1.5 3 6 9 12
Miles
Pre/Post Fire Sites
Sites Sampled Pre-Fire
2009 Station Fire

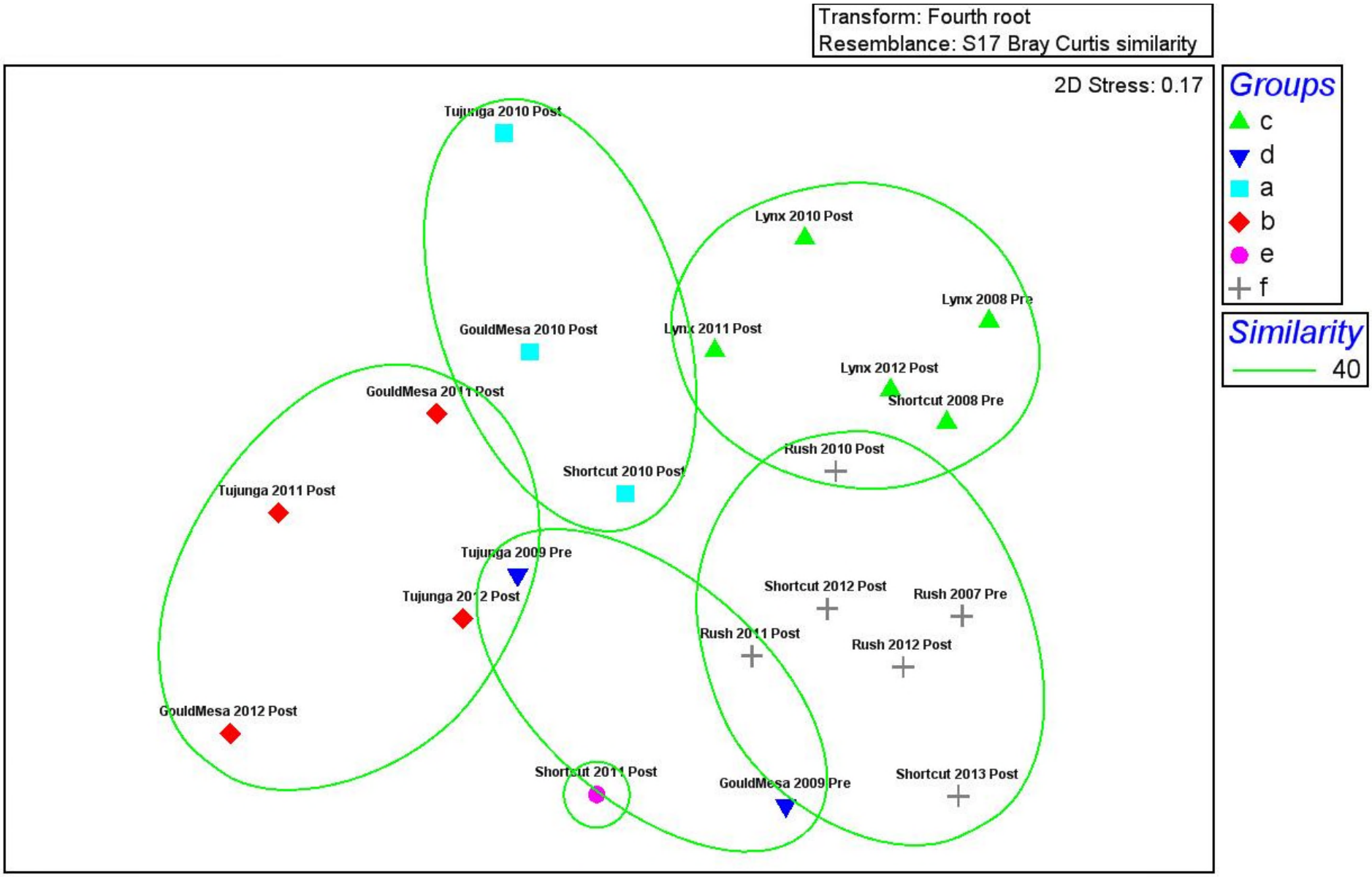
Monitoring Effort

Station	Pre-Fire Sample Year	Post Fire Sample Year				No. of Revisits
Big Tujunga Wash	2009	2010	2011	2012	NS	3
Gould Mesa	2009	2010	2011	2012	NS	3
Lynx Gulch	2008	2010	2011	2012	NS	3
Rush Creek	2007	2010	2011	2012	2013	4
Shortcut Canyon	2008	2010	2011	2012	2013	4

Analysis Methods

- Biological communities (Primer 6)
  - Rare species trimmed (1 occurrence & < 4 individuals)
  - 128 species used for analysis
  - Data 4^{th} root transformed
  - Bray-Curtis Similarity Index
  - Multidimensional Scaling (MDS)
- Abiotic & biological metric data

MDS: Pre & Post Fire Sites



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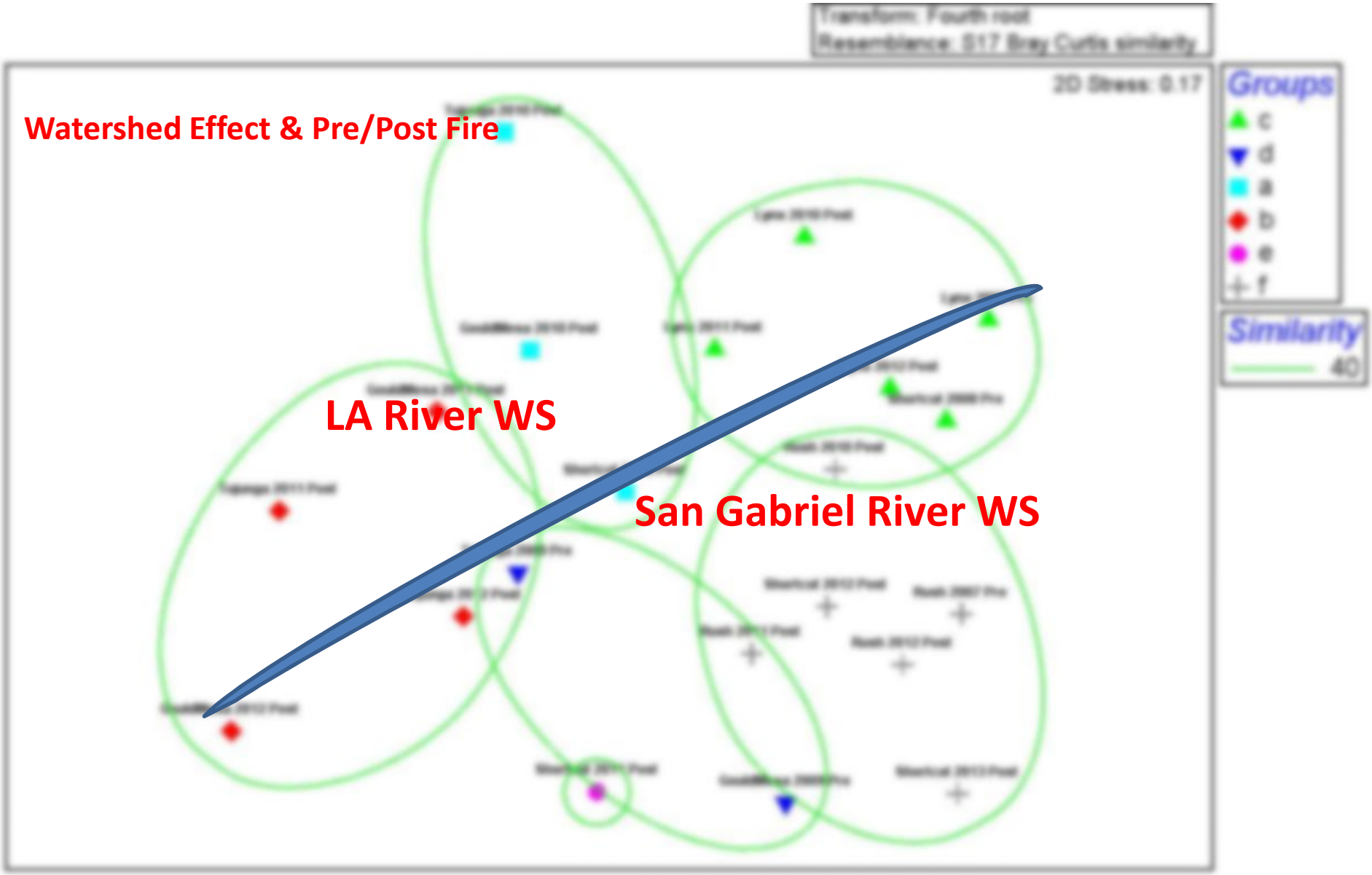
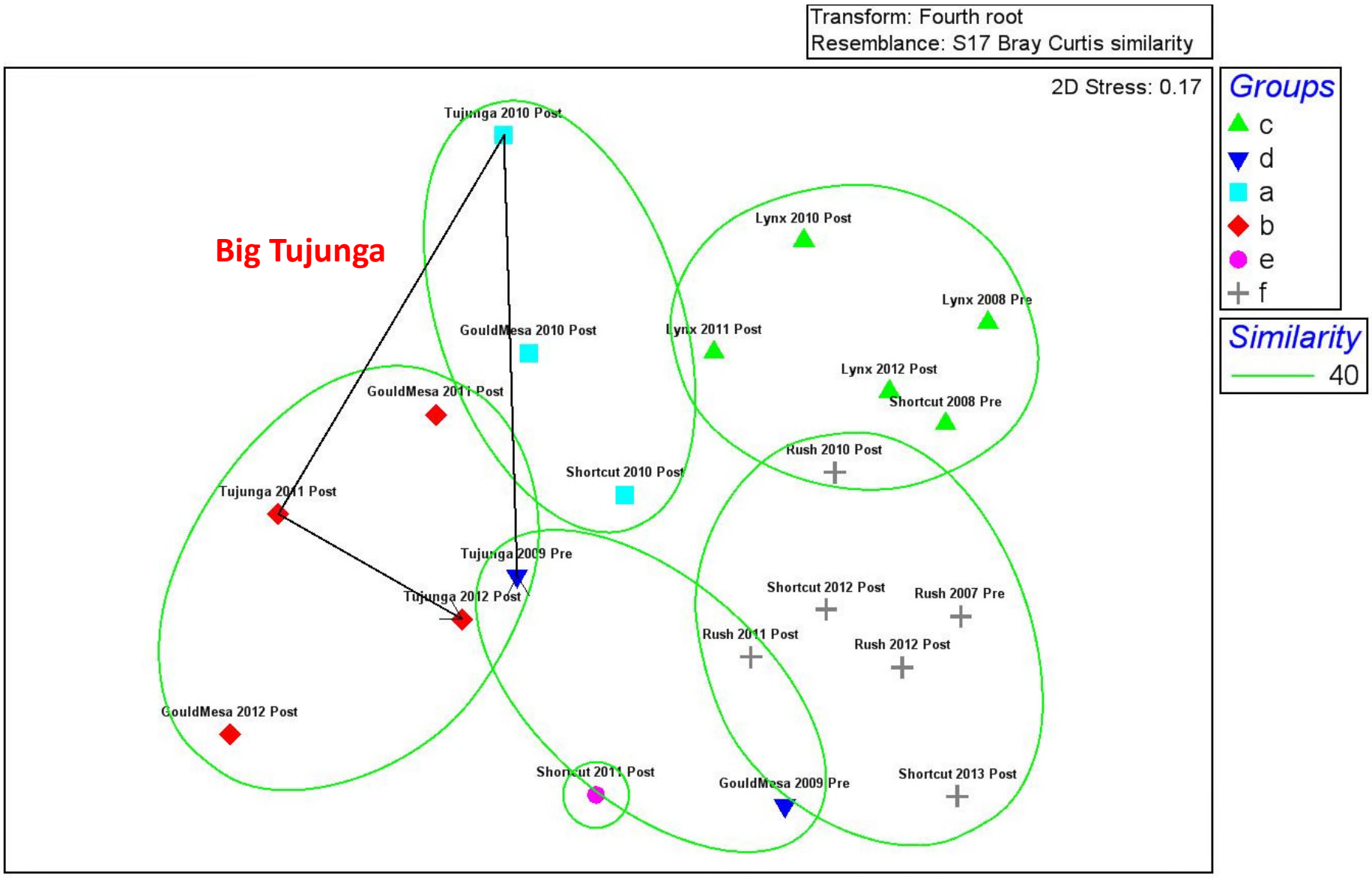


Big Tujunga Wash

Pre-Fire

Post-Fire

MDS: Station Trajectory Through Time

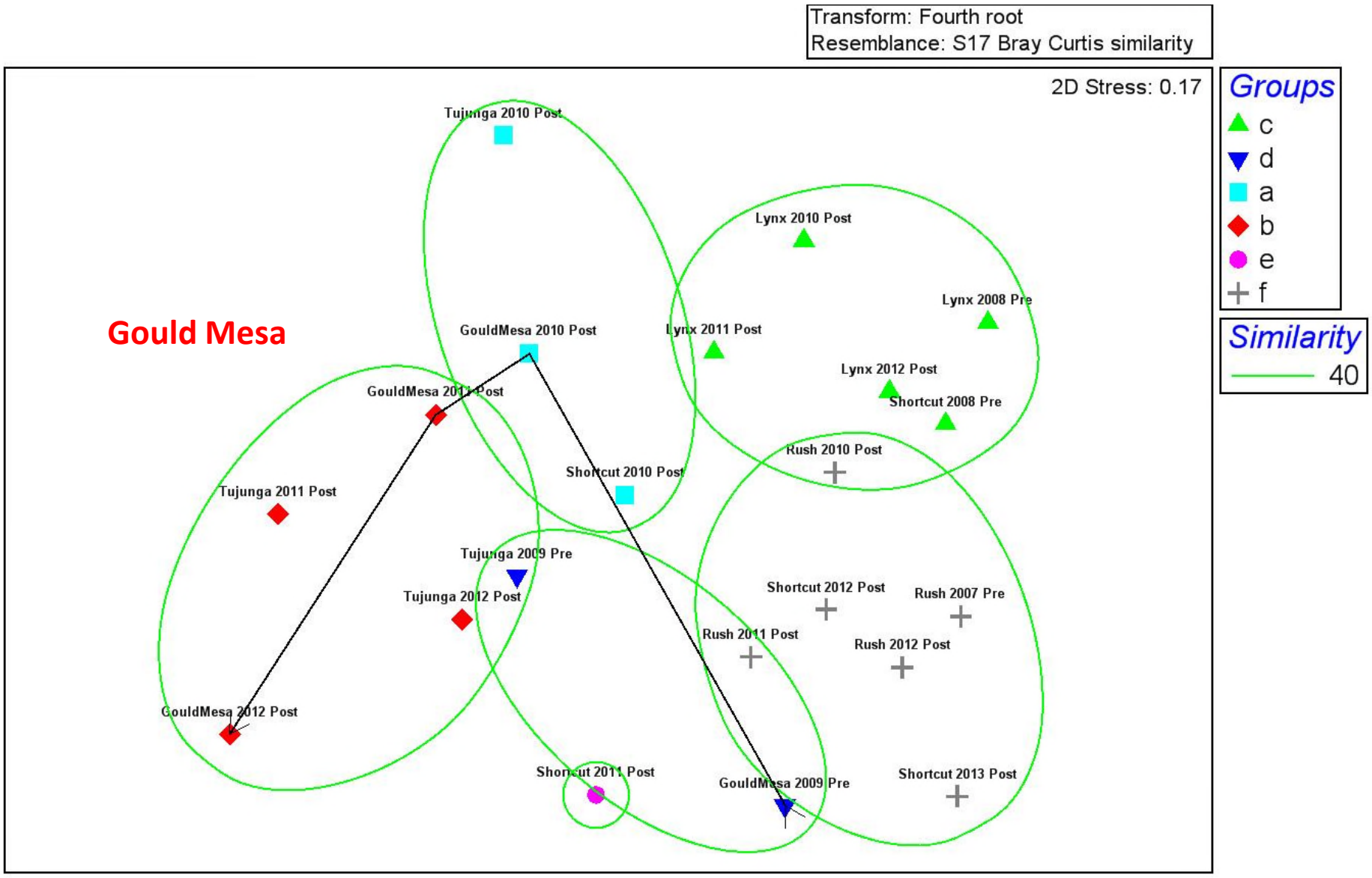


Arroyo Seco at Gould Mesa

Pre-Fire

Post-Fire

MDS: Station Trajectory Through Time

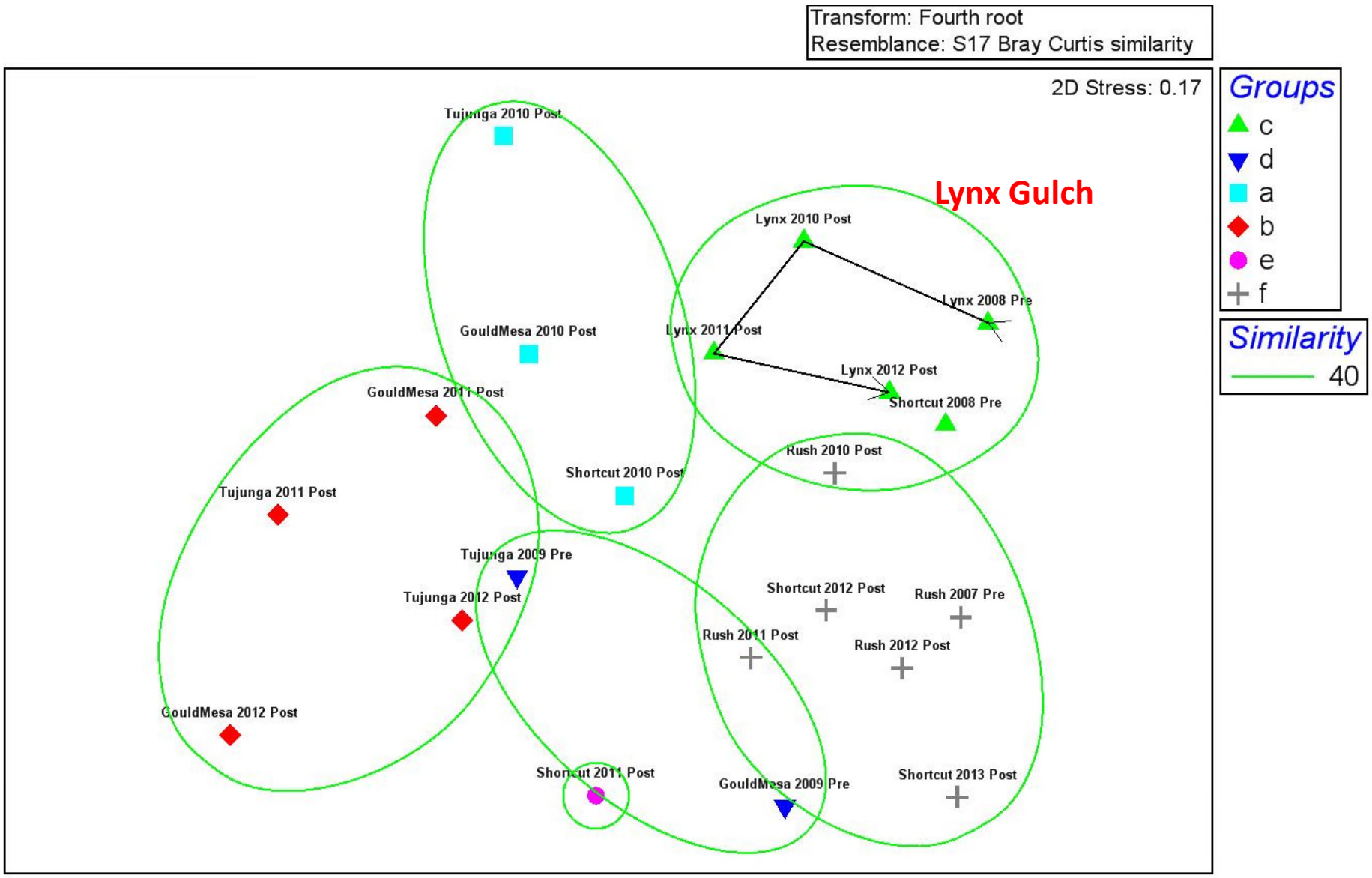


Lynx Gulch

Pre-Fire

Post-Fire

MDS: Station Trajectory Through Time

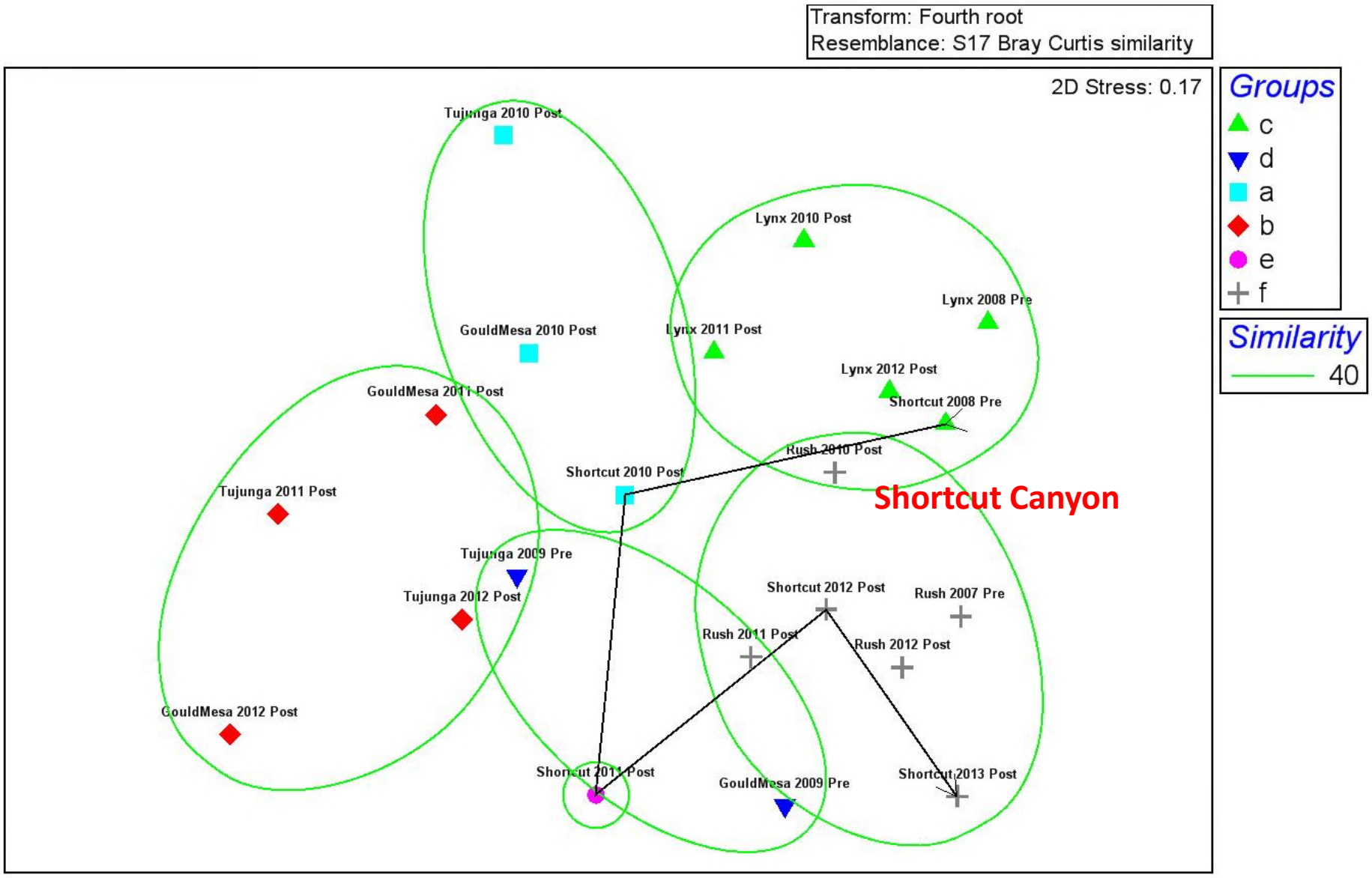


Shortcut Canyon

Pre-Fire

Post-Fire

MDS: Station Trajectory Through Time

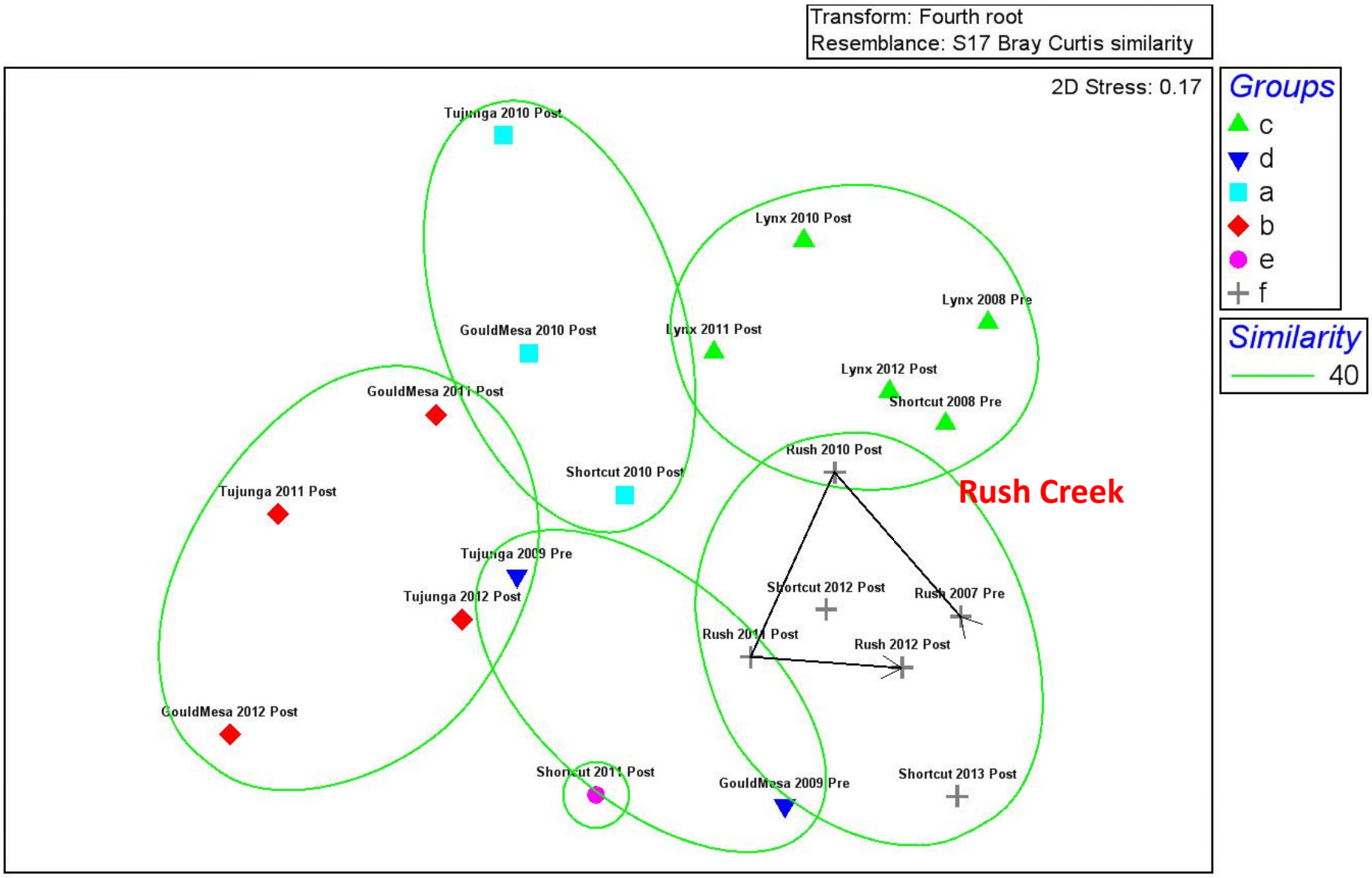


Rush Creek

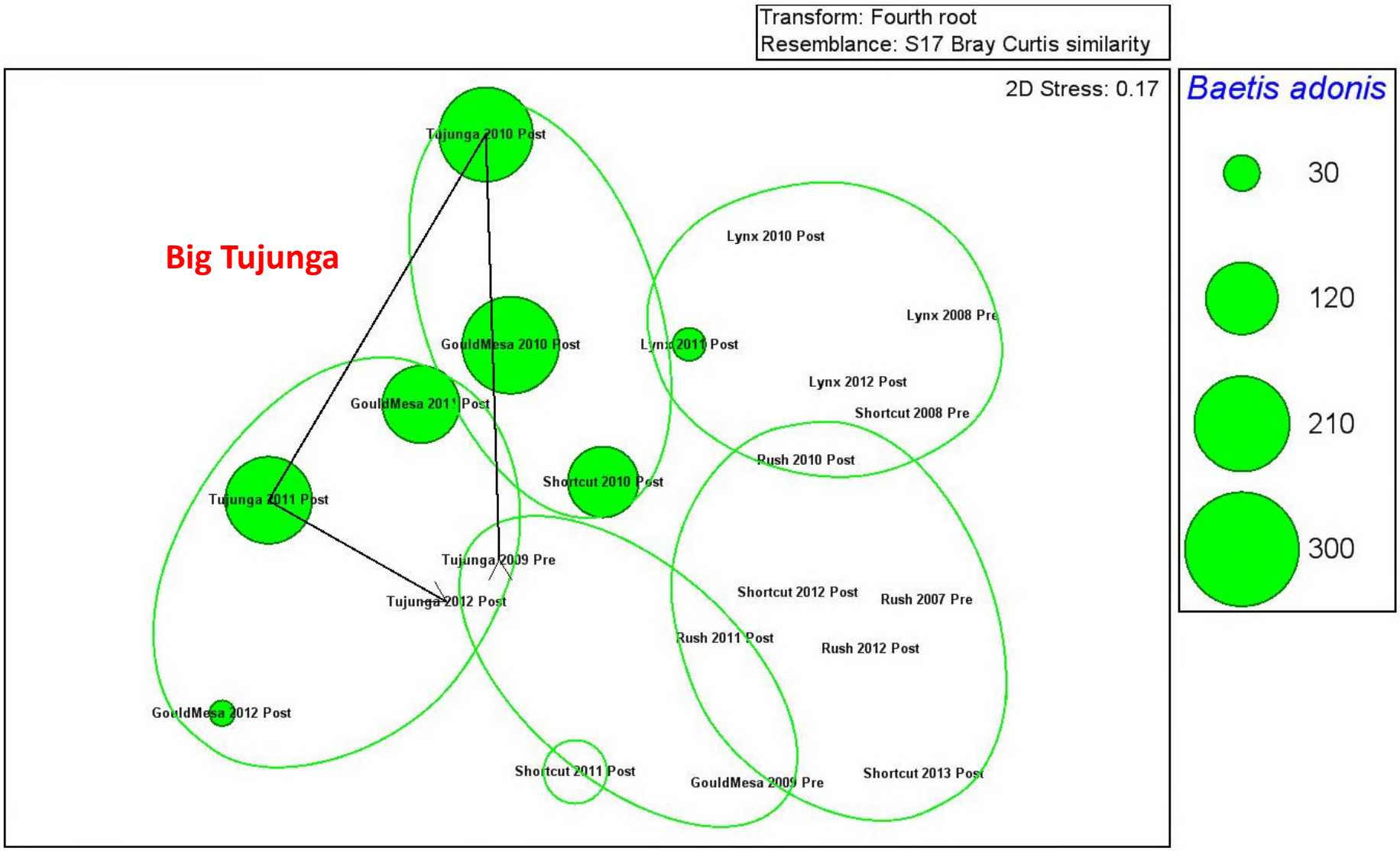
Pre-Fire

Post-Fire

MDS: Station Trajectory Through Time



MDS: Important Species



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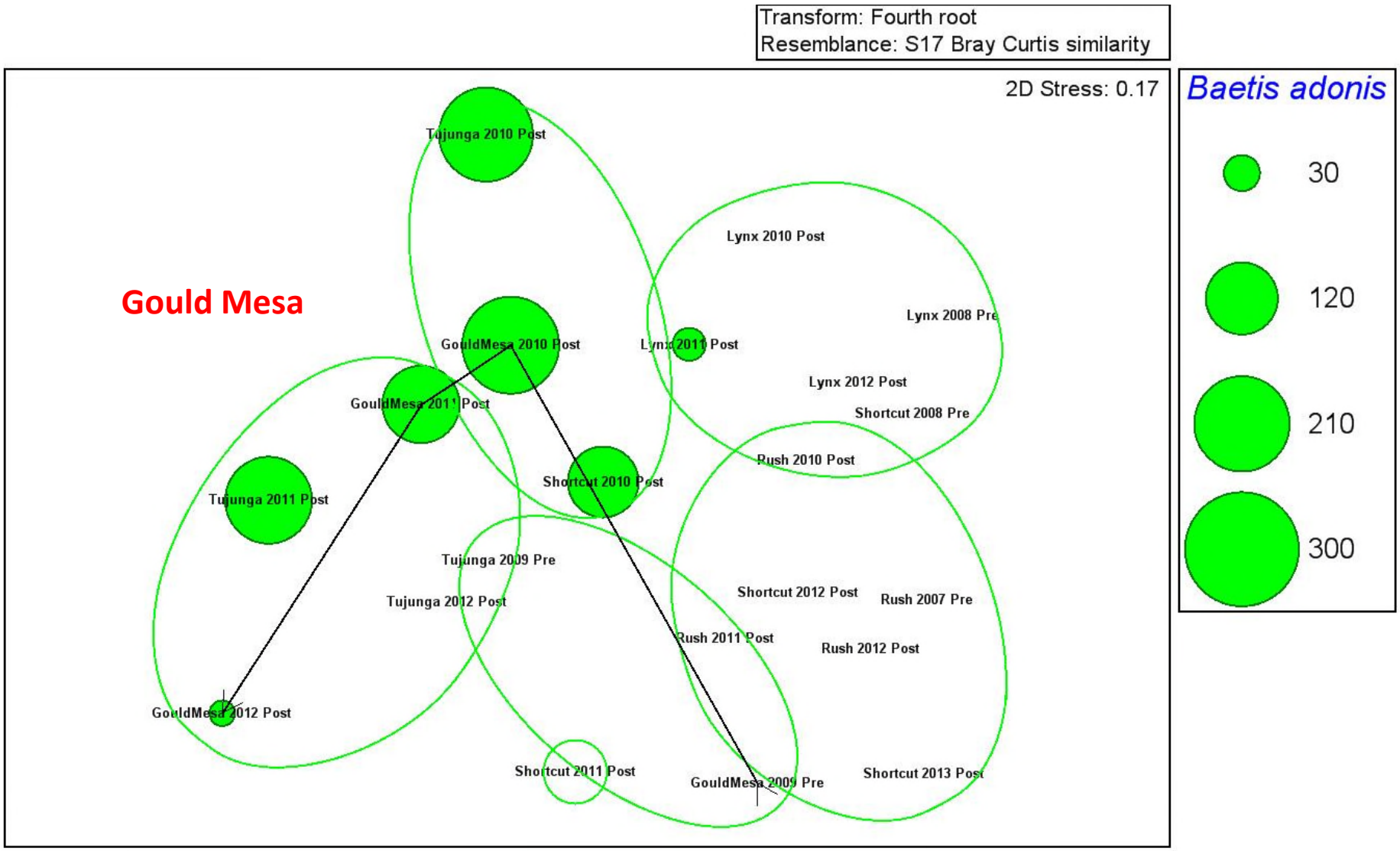

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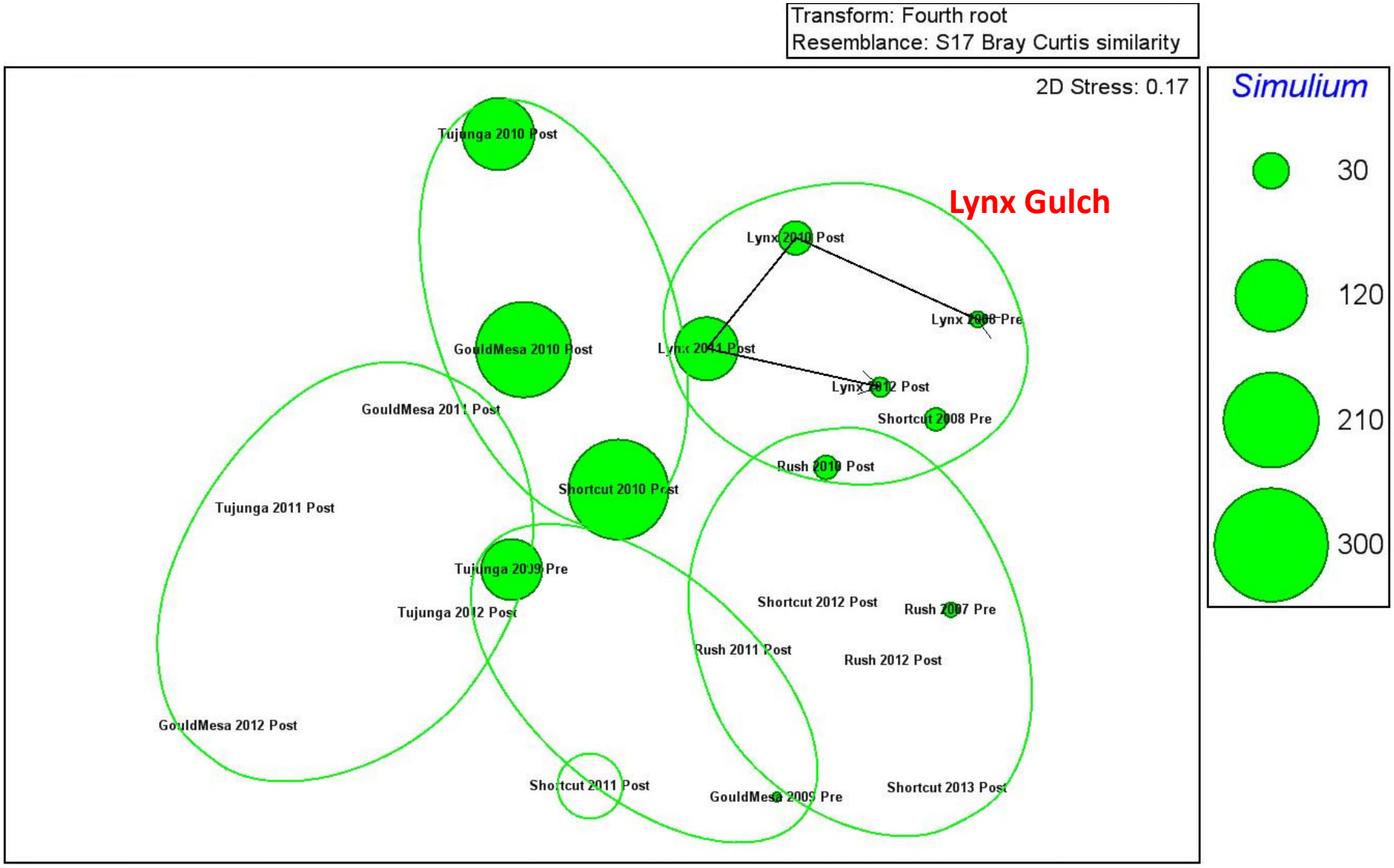

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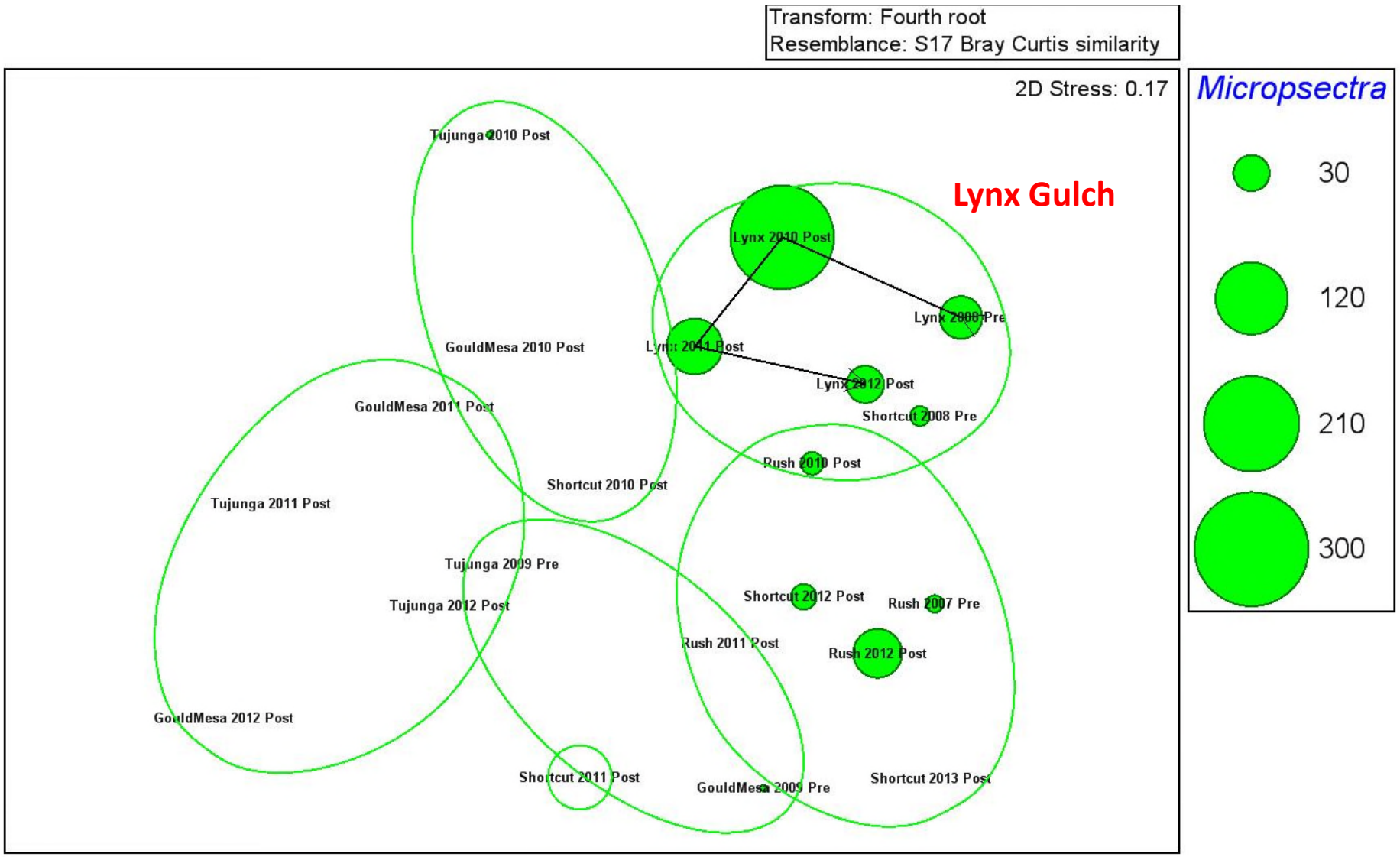

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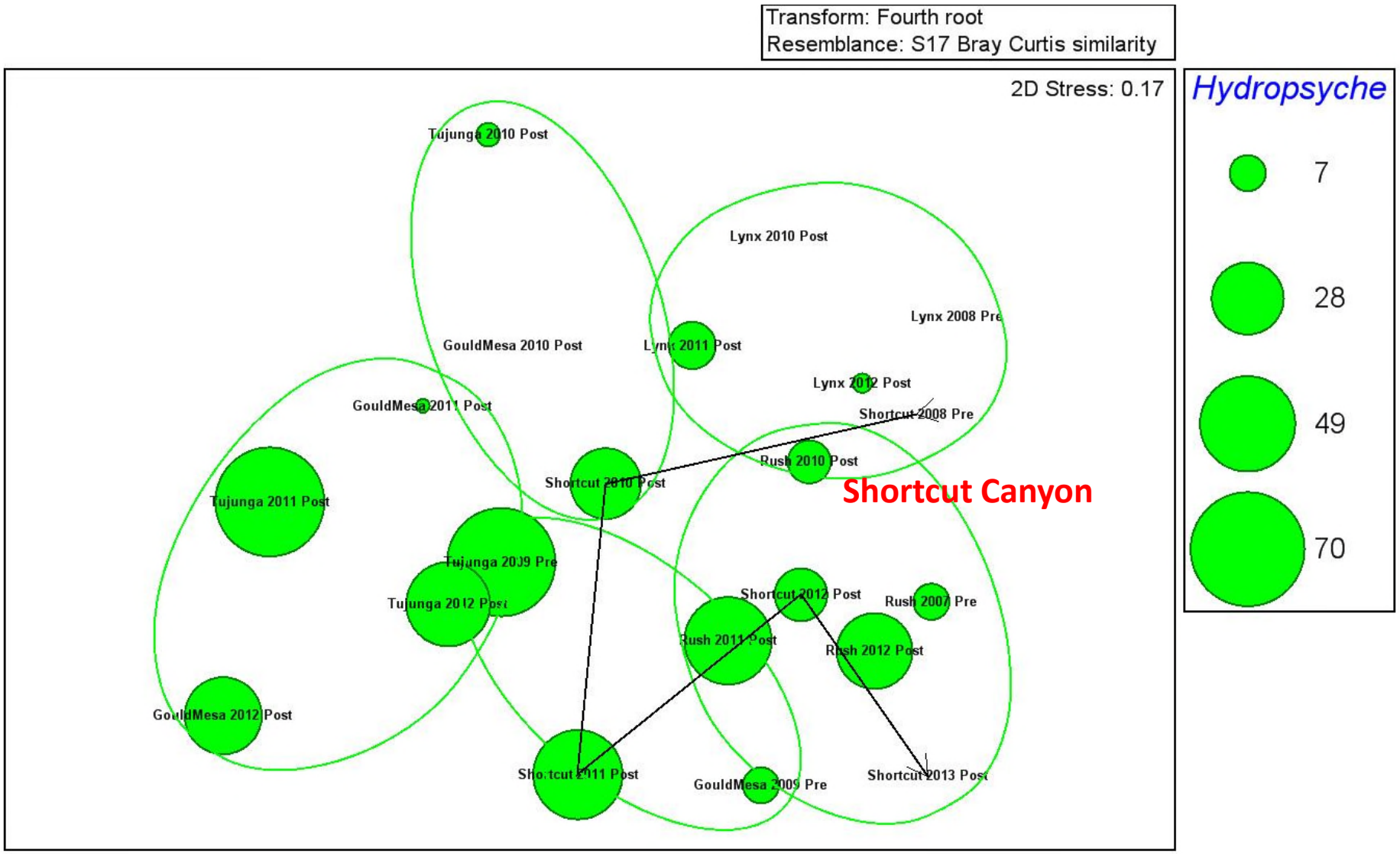

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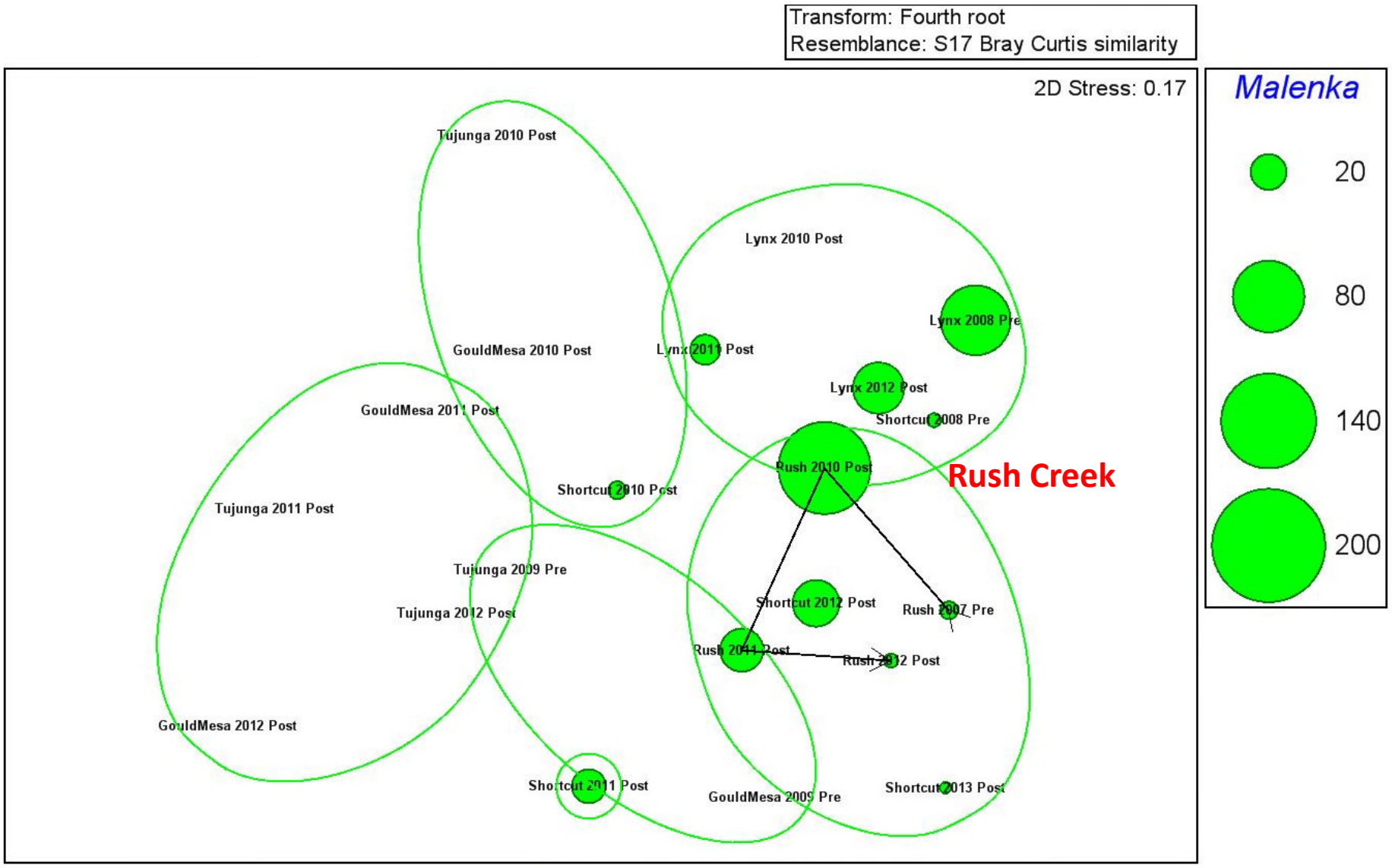
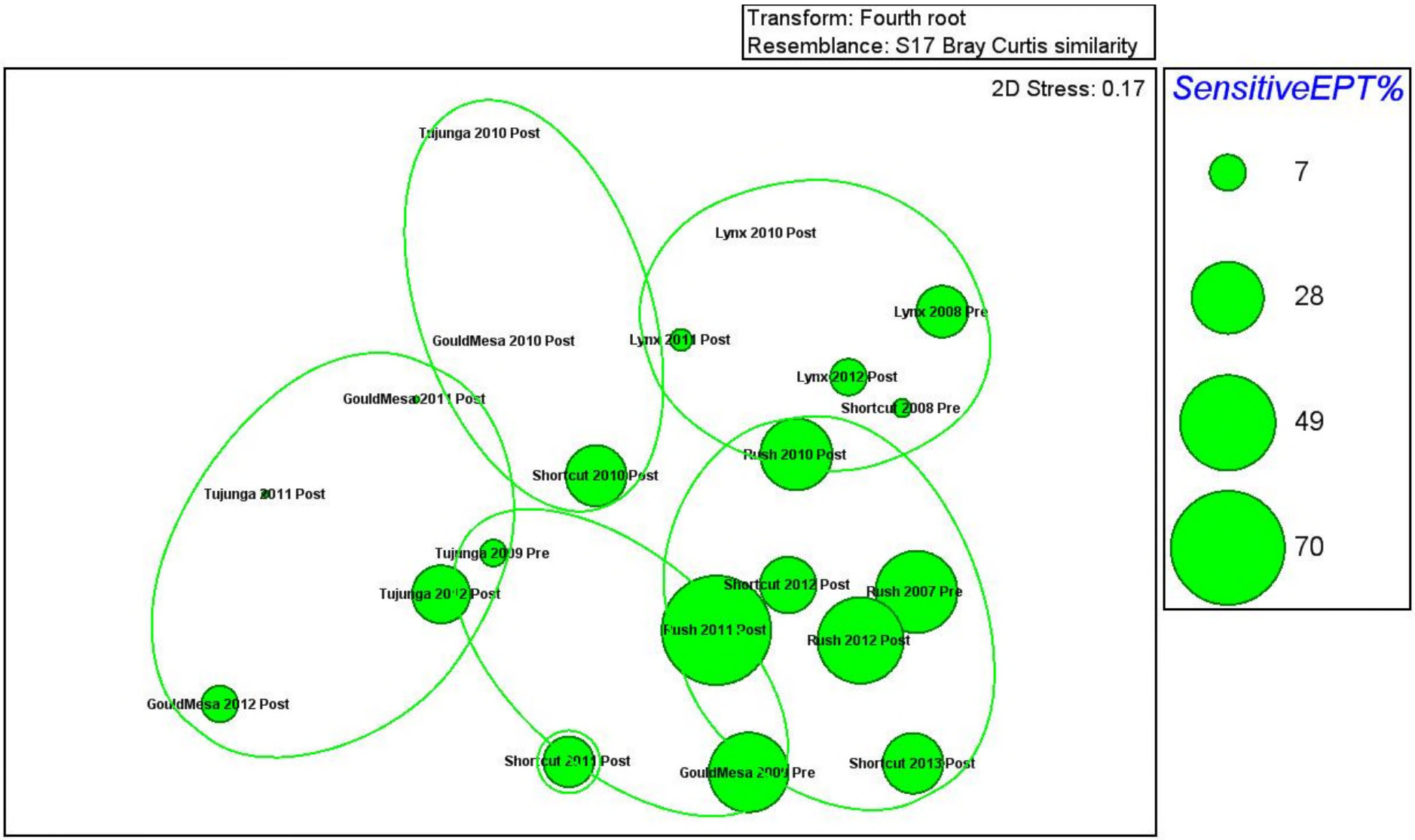


MDS: Important Metrics



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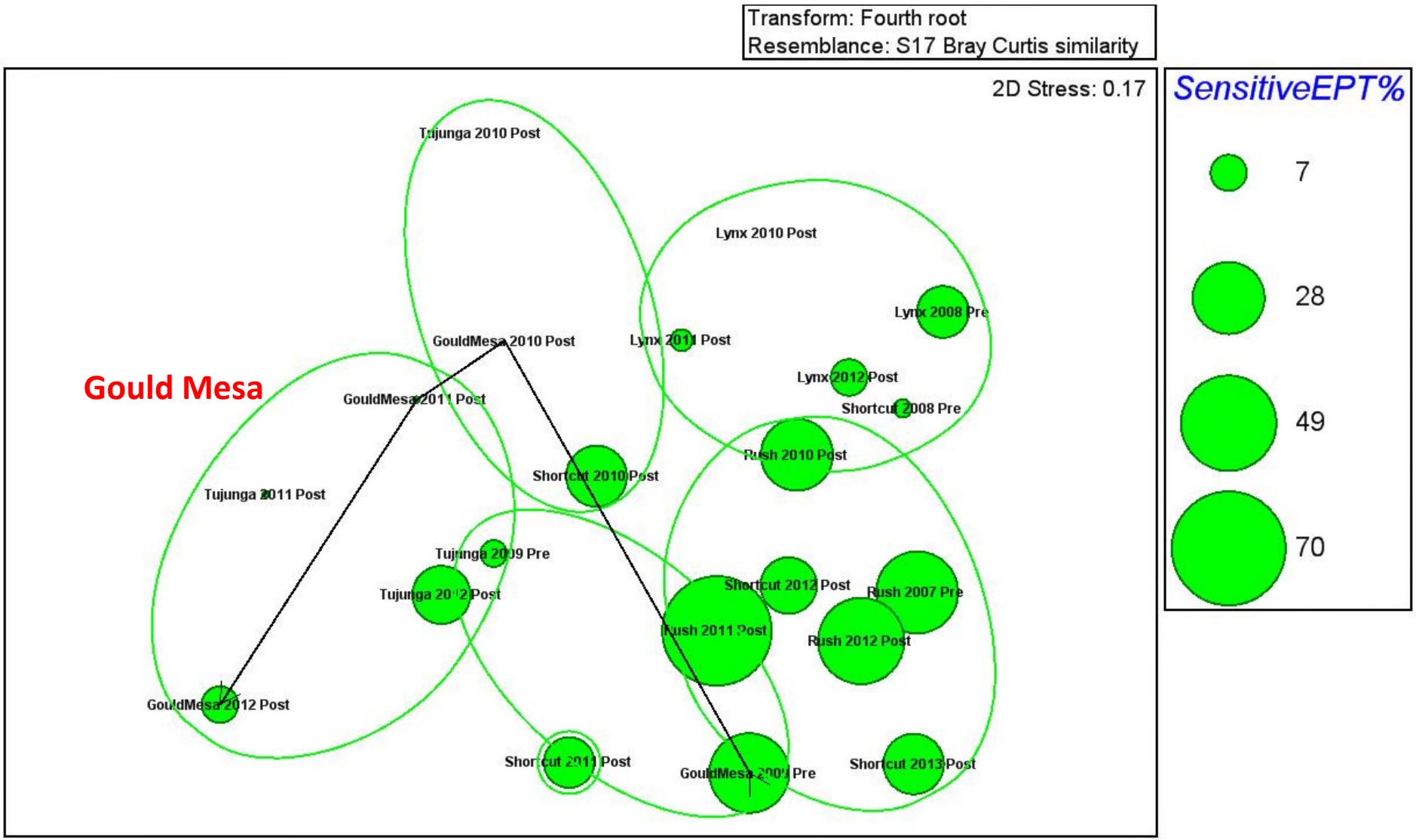

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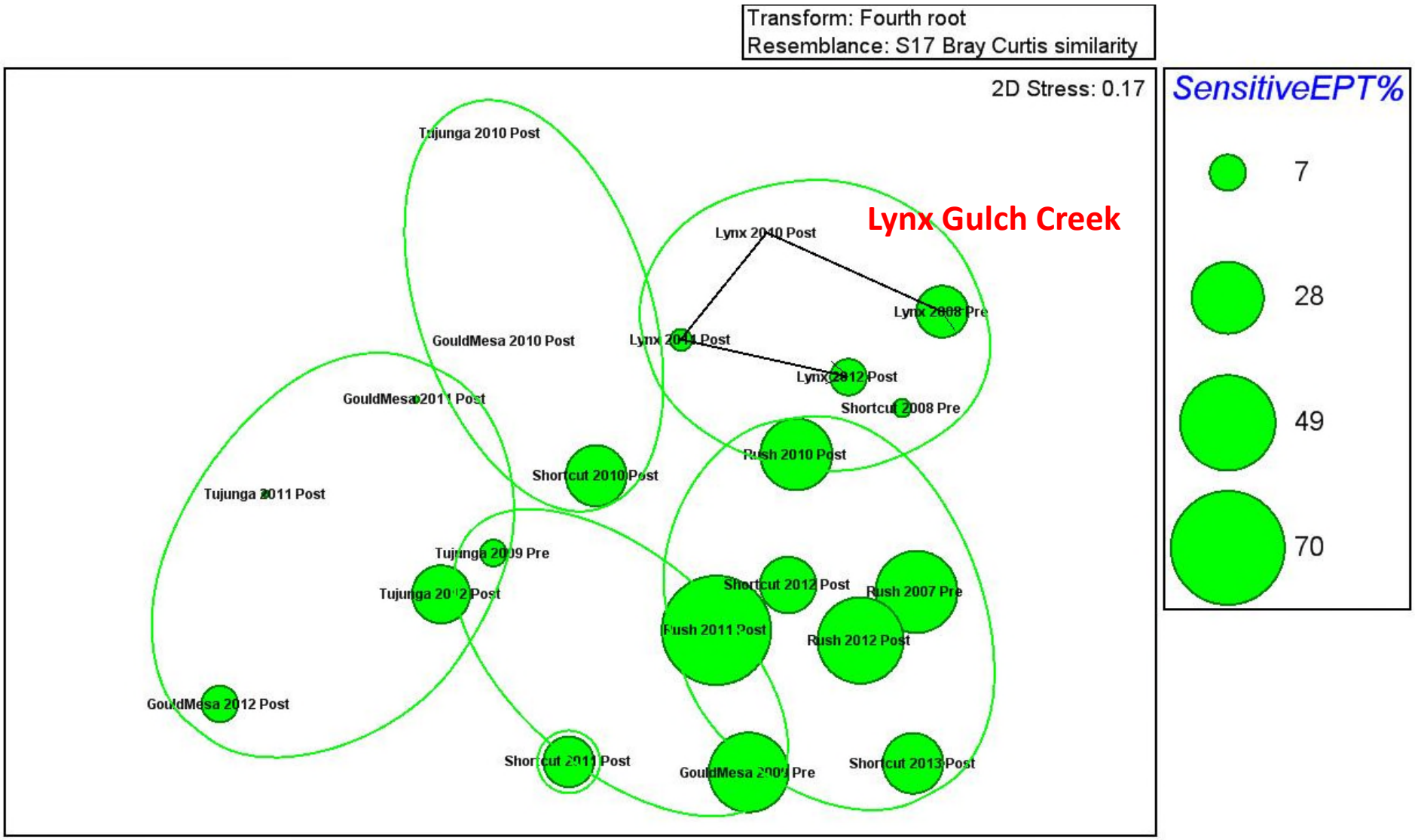

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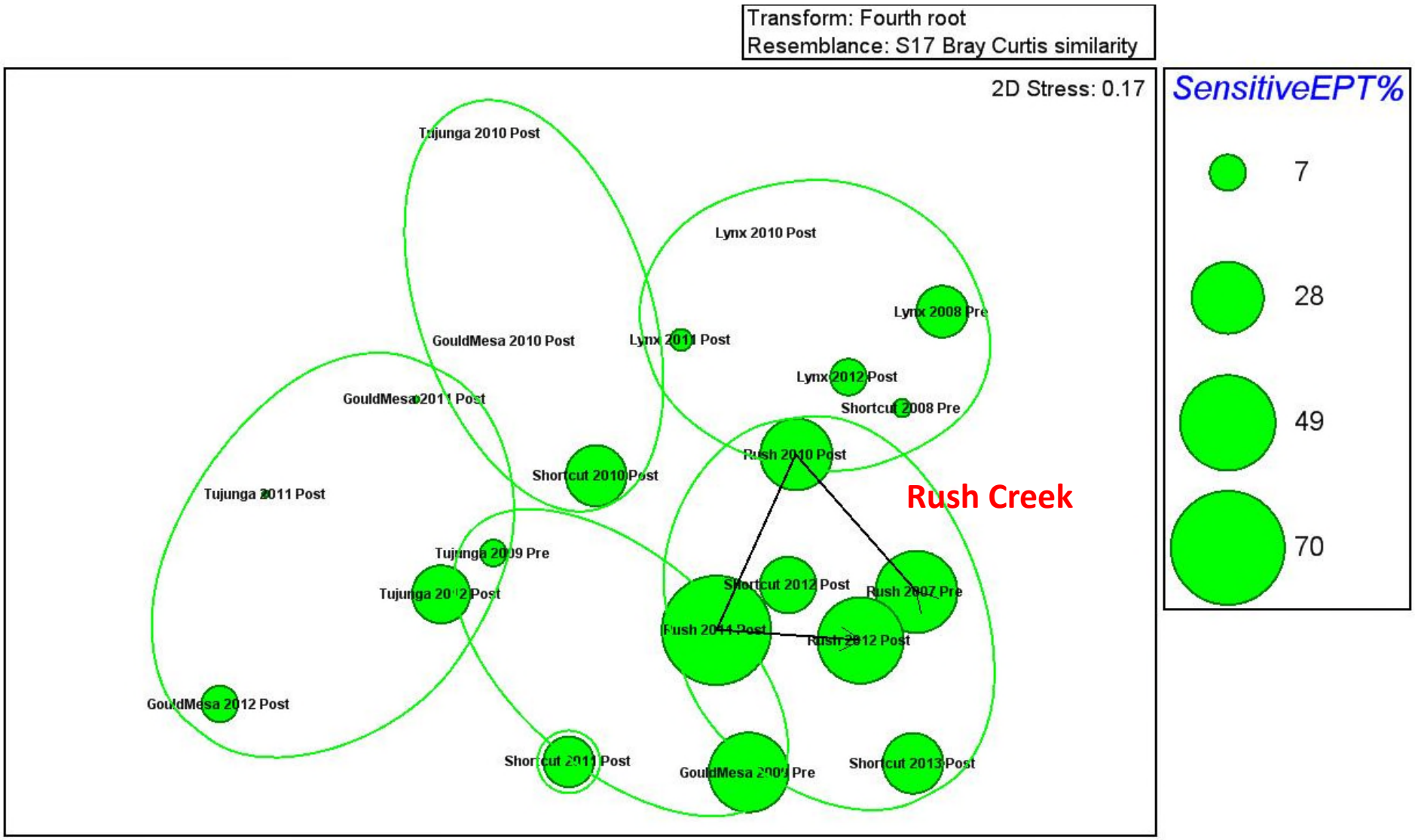

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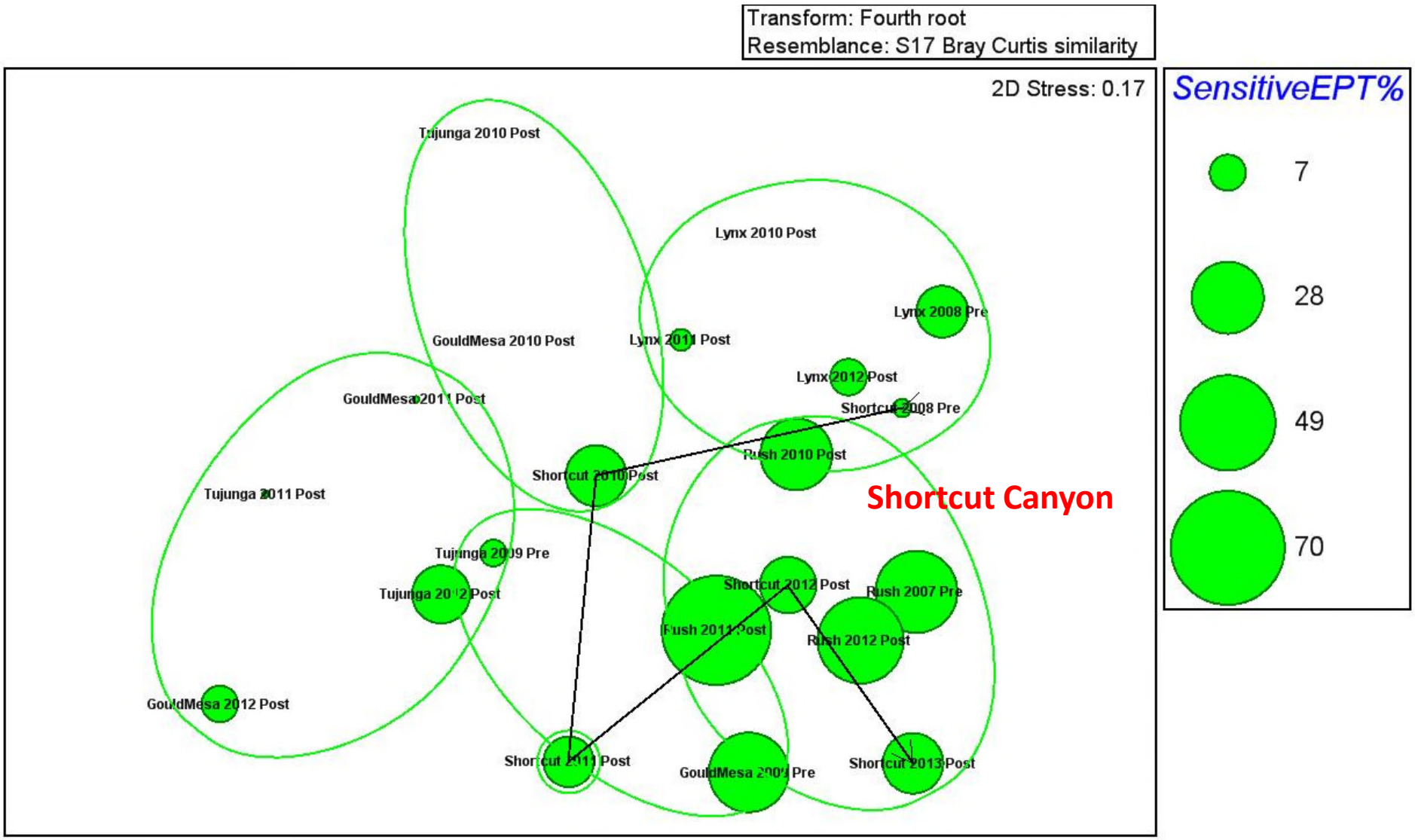

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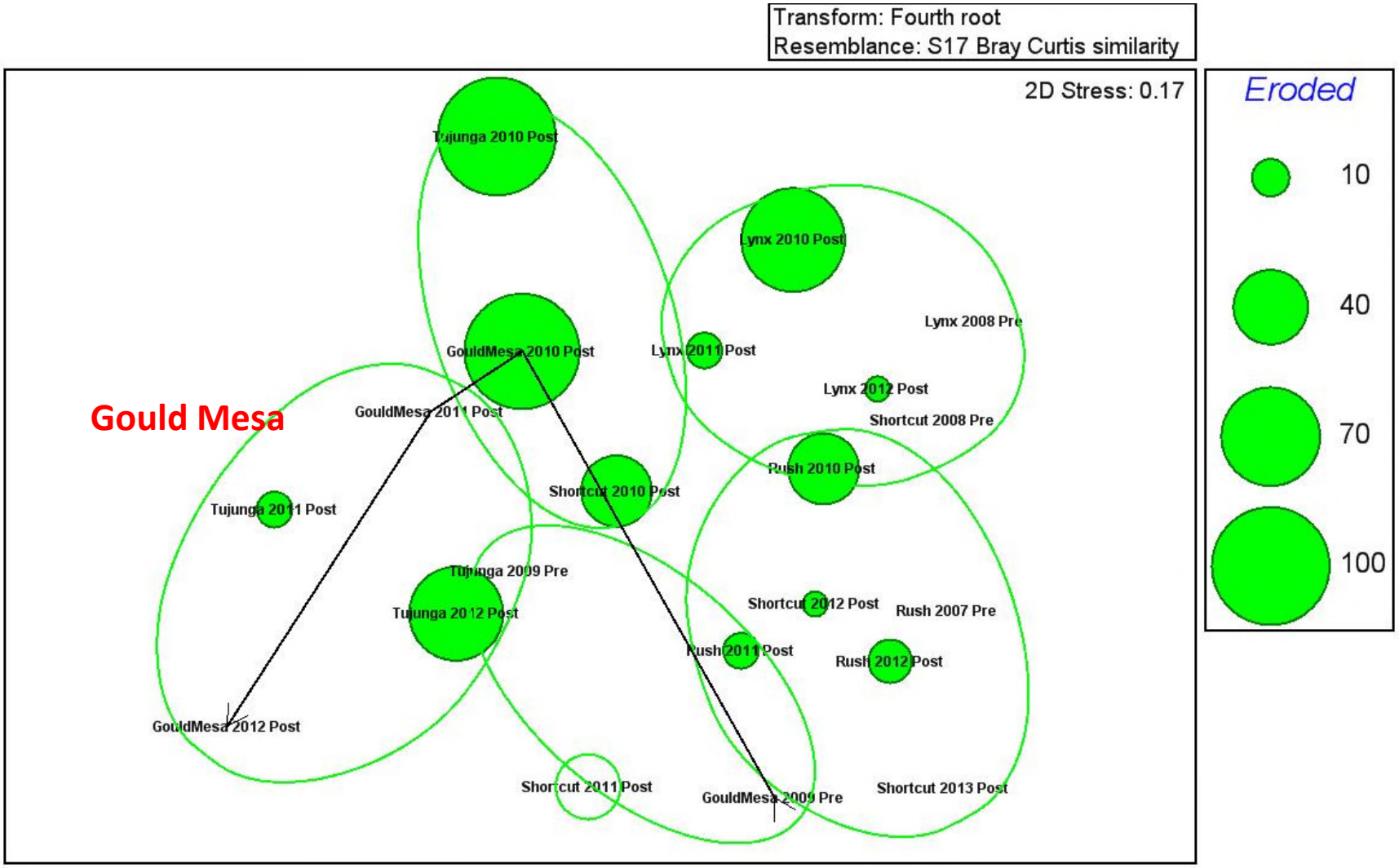

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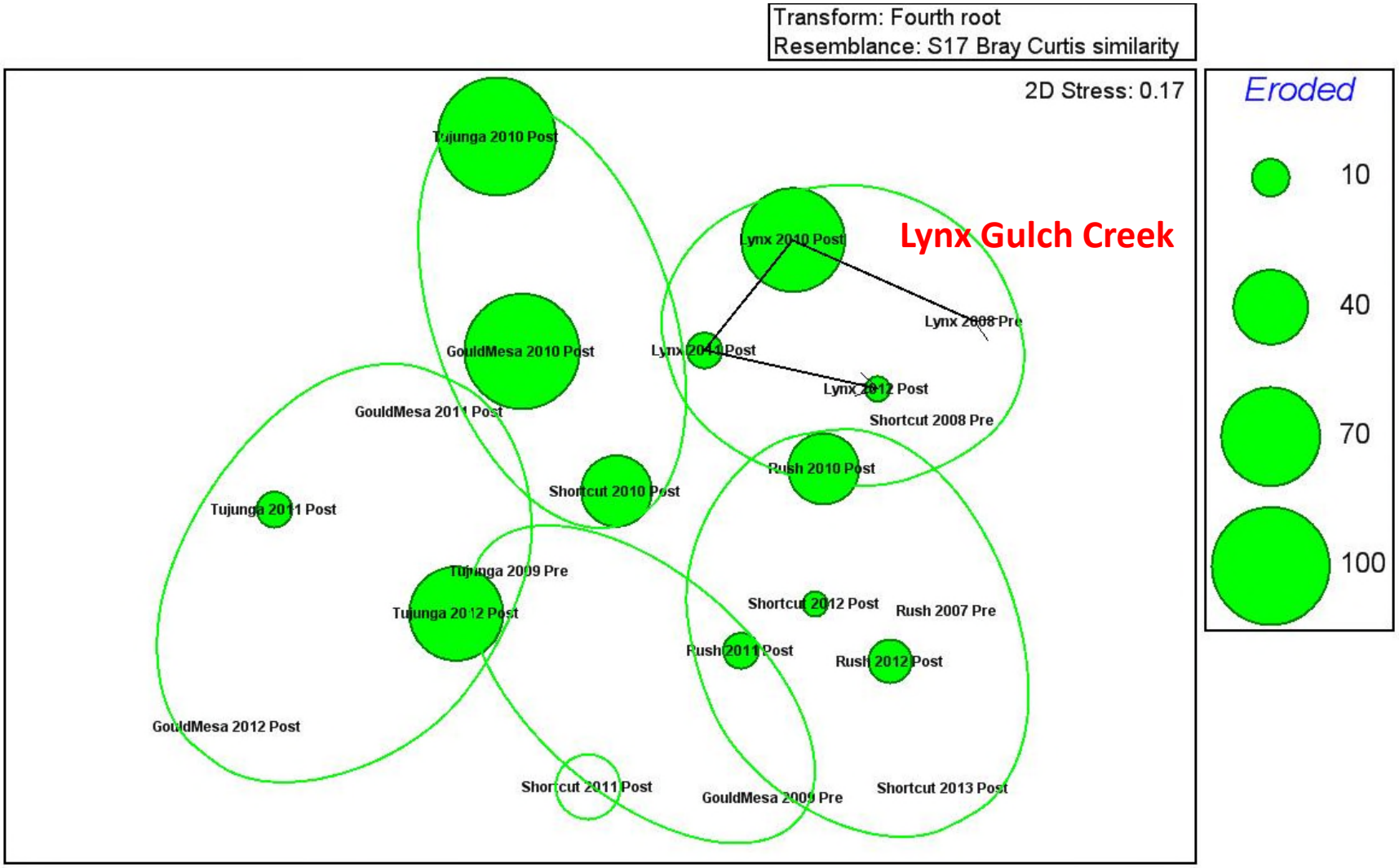

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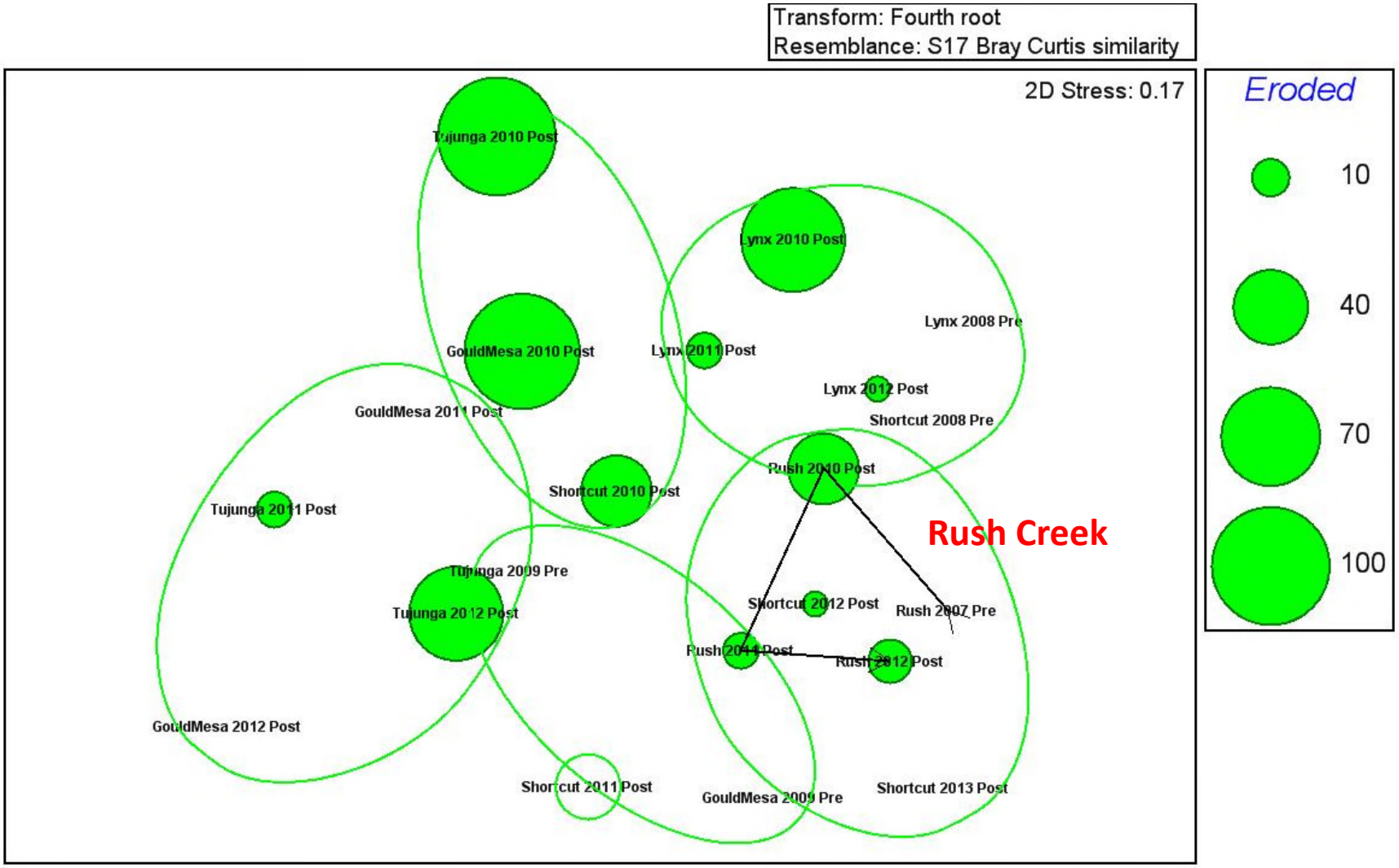

Conclusions

- Bray-Curtis Similarity Index, based on species presence, and MDS showed differences in pre-fire and post-fire conditions
  - We could track changes of biotic and abiotic conditions over time
  - It takes at least two to three years for biological communities to return to pre-fire conditions
- Little information from dry weather chemistry

Lessons Learned

- Increase the number of sites
- Increase sample frequency immediately following event, especially for biology
- Conduct wet weather chemistry sampling below burn sites
- Choose indicators for which there are resources that can be allocated for the duration of the study (5 years)
  - Eliminate data gaps

Thank You Program Partners

SANITATION DISTRICTS OF LOS ANGELES COUNTY

CITY OF LOS ANGELES
SANITATION
DEPARTMENT OF
PUBLIC WORKS

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT

www.ocwatersheds.com
OC Watersheds Program
County of Orange

LA DWP
Los Angeles
Department of
Water & Power

CITY OF BURBANK
100
1911-2011
CENTENNIAL CELEBRATION

SCCWRP
Established 1969

CALIFORNIA
Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

CITY OF DOWNEY
FOUNDED 1873
INCORPORATED 1956
CALIFORNIA

aquatic
bioassay &
consulting
laboratories, inc

Council for
Watershed Health

WESTON
SOLUTIONS
an employee-owned company

2009 Station Fire

Soil Burn Severity (%)				
Watershed	**Unburned/ Very Low**	**Low**	**Moderate**	**High**
Lower Big Tujunga	**8**	**15**	**73**	**4**
Upper Big Tujunga	**18**	**14**	**51**	**17**
Arroyo Seco	**8**	**17**	**64**	**11**
Upper West Fork San Gabriel	**19**	**23**	**49**	**9**
Middle West Fork San Gabriel	**24**	**38**	**38**	**0**

Young, David, 2009. Soil Resource Assessment Station Fire. CA-ANF-3622.

Erosion Hazard Rating (%)				
Watershed	**Unburned/ Very Low**	**Low**	**Moderate**	**High**
Lower Big Tujunga	**5**	**56**	**17**	**22**
Upper Big Tujunga	**1**	**13**	**37**	**49**
Arroyo Seco	**6**	**21**	**35**	**38**
Upper West Fork San Gabriel	**11**	**29**	**22**	**38**
Middle West Fork San Gabriel	**18**	**39**	**20**	**23**

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CRAM and IBI Scores

Score	Los Angeles River Watershed		
	Effluent (mean ± SD)	Urban (mean ± SD)	Natural (mean ± SD)
IBI	10 ± 6.2	10 ± 6.2	40 ± 18.4
CRAM	35 ± 5.2	37 ± 8.8	74 ± 12.3

Score	San Gabriel River Watershed		
	Mainstem (mean ± SD)	Lower (mean ± SD)	Upper (mean ± SD)
IBI	13 ± 6.8	15 ± 14	55 ± 16
CRAM	35 ± 3.9	45 ± 18	86 ± 7.2